ABSTRACT

The Wager Bay area in northeastern Keewatin was surveyed for nests of raptorial birds during late July and August, 1976. A total of 14 peregrine falcon nests, 5 gyrfalcon nests, 11 rough-legged hawk nests, one golden eagle nest, and 28 possible nest sites of unidentified raptors were located. Eighty-seven percent of the peregrine falcon nests successfully fledged young: (an average of 2.08 young/nest and 2.45 young/successful nest). Six rough-legged hawk nests visited produced a total of 18 young. On the basis of the results of this study, Wager Bay is considered a raptor nesting area of major importance, especially for the rare and endangered peregrine falcon. The peregrine falcons of Wager Bay produced more young in 1976 than did those of any other area in North America surveyed during the 1975 North American Peregrine Falcon Survey. Further studies are proposed to assess the number and productivity of peregrine falcons in key areas of northeastern Keewatin District and along proposed pipeline routes. Studies to assess pesticide levels in falcon populations from this area are also proposed.

NUMBERS AND PRODUCTIVITY OF RAPTORIAL BIRDS IN THE WAGER BAY AREA OF NORTHEASTERN KEEWATIN

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March, 1977

RESTRICTED - not for publication

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The Wager Bay area in northeastern Keewatin was surveyed for nests of raptorial birds during late July and August, 1976. A total of 14 peregrine falcon nests, 5 gyrfalcon nests, 11 rough-legged hawk nests, one golden eagle nest, and 28 possible nest sites of unidentified raptors were located. Eighty-four percent of the peregrine falcon nests successfully fledged young: (an average of 2.08 young/nest and 2.45 young/successful nest). Six rough-legged hawk nests visited produced a total of 18 young. On the basis of the results of this study, Wager Bay is considered a raptor nesting area of major importance, especially for the rare and endangered peregrine falcon. The peregrine falcons of Wager Bay produced more young in 1976 than did those of any other area in North America surveyed during the 1975 North American Peregrine Falcon survey. Further studies are proposed to assess the number and productivity of peregrine falcons in key areas of northeastern Keewatin District and along proposed pipeline routes. Studies to assess pesticide levels in falcon populations from this area are also proposed.

INTRODUCTION

Because raptorial birds are susceptible to disturbance by construction and operation of a petroleum pipeline, their nesting areas must be given high priority in routings and scheduling of any pipeline construction (Gunn, 1975). Raptor populations are often limited by the availability of nest sites (Newton, 1976). If these nest sites are destroyed by quarrying or construction the population would decline. Construction activities or operation of aircraft and other vehicles may inadvertently disturb birds during courtship or nesting. The highly visible birds themselves will attract pipeline personnel who may intentionally or unintentionally disturb them. Such disturbances could cause birds to fail to nest, or to abandon eggs, or young. Raptorial birds, by their very nature as predators at the top of the food pyramid, are usually not abundant, and some species, such as the peregrine falcon, have suffered declines which place them on the list of rare and endangered wildlife (Godfrey, 1970). These endangered populations cannot sustain further declines.

The objectives of this study were:

1. To locate nest sites of peregrine falcons and other raptors which must be considered in routing a pipeline.
2. To determine raptor density and productivity to use in evaluating the regional importance of any individual nest which might be affected by pipeline construction.
3. To provide background information on raptor density and productivity against which post-construction changes can be evaluated.

METHODS

The Study Area

The area searched for raptor nests included the shoreline of Wager Bay and Brown Lake, and the shores of adjacent rivers and lakes within about 10 - 20 miles (Fig. 1). Rocky hills (elevations up to 580 m), rock outcrops, and cliffs along rivers that occur throughout the area provide innumerable ledges potentially suitable for nesting by raptors.

The tundra habitats in this area range from wet lowland areas dotted with lakes, ponds, and standing water to well drained upland sites. Prey species include abundant populations of small mammals (ground squirrels, arctic hares, lemmings); passerine birds, such as horned larks, Lapland longspurs, and snow buntings; and larger birds, such as ptarmigan, long-tailed jaegers, waterfowl, shore birds, gulls, and alcids.

Survey Techniques

Since the Wager Bay area had not been searched previously for raptors, we had no prior knowledge of nest sites, or of suitable nesting habitat. We concentrated our searches along the shores of Wager Bay and Brown Lake, and along lakes and rivers where 1:250,000 topographic maps showed cliffs or broken relief. We searched by flying close to cliffs and outcrops, looking for whitewash, nests, or flushed birds. When whitewash was observed on a cliff, we flew several passes by the cliff to locate any nests or scraps. When a nest was observed we counted eggs or young, if possible. Raptors were identified to species where possible. All sightings of possible nest sites and confirmed occupied nests were plotted on 1:250,000 maps.

Where possible we later visited suspected nest sites on foot to locate and describe the nest and site, to count numbers of eggs and young, to determine the developmental stage of the young, and to collect any addled eggs for analysis

of egg shell thickness and pesticide residue. Eggs were sent to Richard Fyfe of the Canadian Wildlife Service for analysis.

RESULTS

Number and Location of Raptor Nest Sites

We located 14 active peregrine sites and three suspected peregrine sites; 11 rough-legged hawk sites, five gyrfalcon sites, and one golden eagle site. We also plotted 28 sites where raptors may have been nesting or may have nested in the recent past (Fig. 1).

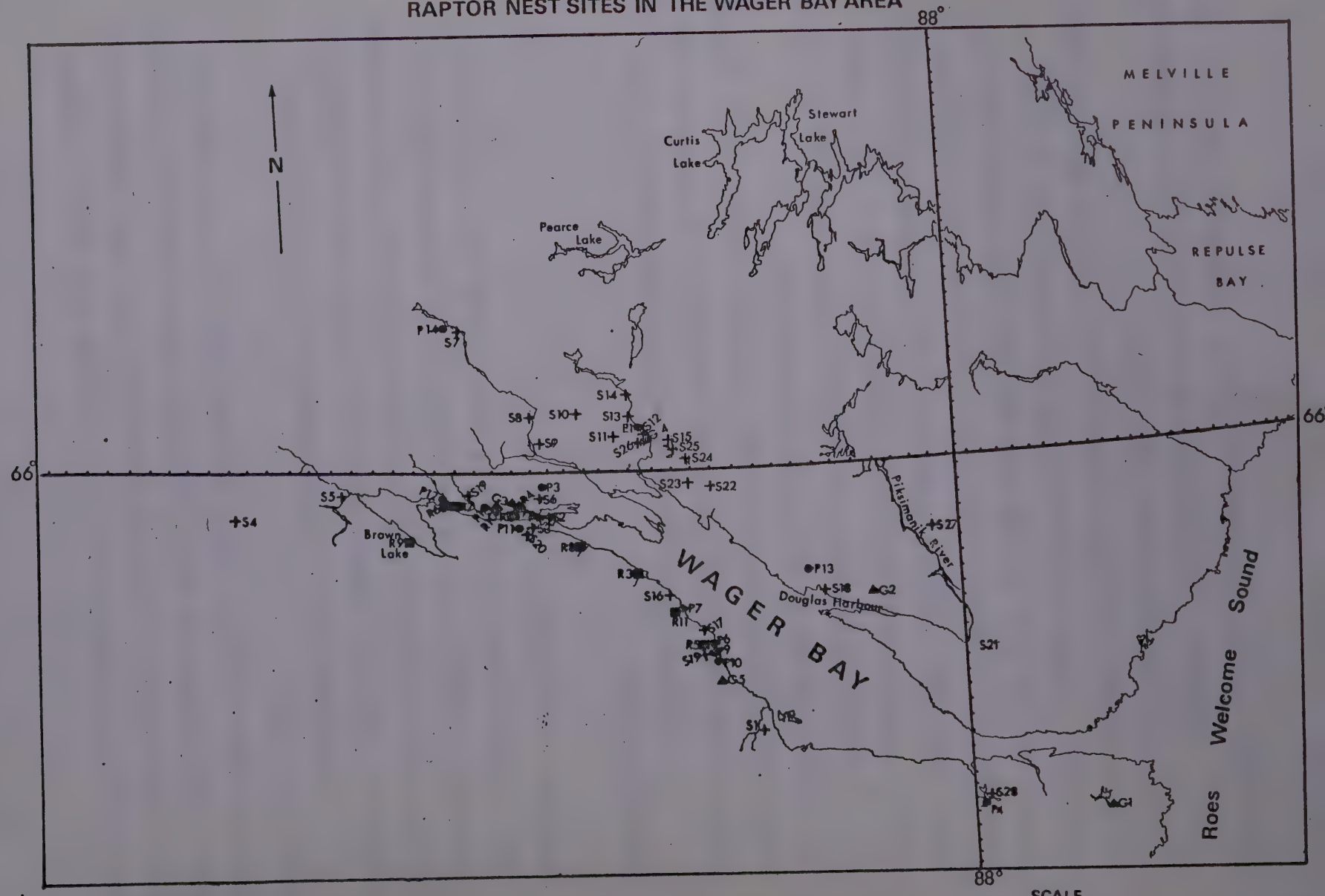
Our surveys were conducted at the optimal time for locating peregrine falcon and rough-legged hawk sites. Young of both species were present in the nests, but had not yet fledged. The parents had been using perches for several weeks so guano stains were highly visible. The young of gyrfalcons, conversely, were fledged and flying at the time of our surveys and thus likely to be away from the nest sites. Thus our survey was probably much less successful in locating gyrfalcon sites than it would have been if conducted a month earlier.

All nests were located on cliffs or rock outcrops, none were on soil cutbanks. The types of nest sites chosen by the four raptor species are indicated in Table I. Peregrine falcons nested predominately on cliffs by the sea or above lakes. Only one confirmed peregrine site was on a river cliff, although steams flowed near several other sites. Rough-legged hawks nested throughout the area, using rock outcrops away from bodies of water as well as cliffs on the sea, lakes and streams. The number of gyrfalcon nests located was too small to draw firm conclusions, but we found none on sea cliffs.

Peregrine falcons nested on high, sheer cliffs, and on cliffs protected by water at their bases. Rough-legged hawks often used lower, less protected cliffs. However, most of the nests of all species were on or near broad ledges.

Figure 1. Map of Wager Bay showing area searched for raptor nests and the location of nest sites.

RAPTOR NEST SITES IN THE WAGER BAY AREA



Only one peregrine falcon nest required use of a rope to be reached. Peregrine falcons and gyrfalcons nested both in scrapes and in stick nests, although their use of scrapes predominated (8 of 11 classified peregrine falcon nests (Table II). Rough-legged hawks used stick nests. The golden eagles used a stick nest on a vertical cliff face.

The minimum distance recorded between two active peregrine falcon eyries was 1.3 km. which, coincidentally, was the same as the minimum distance observed between active rough-legged hawk nests. The distance between peregrine falcon sites averaged 5.44 km if two isolated sites in the eastern part of the survey area are excluded, and 19.3 km if these two sites are included. Rough-legged hawk sites averaged 8.0 km apart.

Reproductive Success

The reproductive success of the peregrine falcons and rough-legged hawks are summarized in Tables II and III. Our surveys of gyrfalcons were too late to permit counting young in the nests, although we observed what we believed to be young of the year in the vicinities of nest sites.

Both peregrine falcons and rough-legged hawks enjoyed good reproductive success. Of the 13 peregrine falcon sites which we visited 11 (85%) produced young. These nests produced a minimum of 27 young, an average of 2.45 young/successful nest. Four of the successful nests were not visited until after the young were on the wing. Thus the total production from these nests might have been higher, if some of the young had left the nest area prior to our visit. If we exclude these nests from the productivity calculations the figure becomes 2.71 (19/7) young/successful nest before fledging.

The number of young was known for only 6 of the 11 active rough-legged hawk nests. These 6 nests produced 18 young or 3.0/successful nest (Table III).

TABLE I SITE CHARACTERISTICS AND SPACING OF RAPTOR NESTS - WAGER BAY, N.W.T.

Species	Number of Nests Located	Number on Lakes	Number on Streams	Number on Sea	Other	Minimum Distance Between Sites	Average Distance Between Sites
Peregrine falcon	14 + 3 possible	6	1	7	-	1.3 km	5.44 (19.3)[1] km
Gyrfalcon	5	3	-	-	2	-	-
Rough-legged hawk	10 + 3 possible	1	3	2	4	1.3 km	8.0 km

1 see text for explanation

TABLE II REPRODUCTION BY PEREGRINE FALCONS AT WAGER BAY, N.W.T.

Nest	Date Visited	Type Nest	Number of Young	Addled Eggs	Population Production Statistics
P1	25 July - 1 August	Stick	0	1*	percentage of nests with young = 85% (11/13) number of young + eggs/nest = 2.31 (30/13) number of young/nest = 2.08 (27/13)
P2	4 August	Rock Ledge	4	0	
P3	7 - 8 August	Scrape Grassy Ledge	4	0	number of young/nest with young = 2.45 (27/11)
P4	7 August	?	3 - 4+	0	number of young/nest with young before fledging = 2.71 (19/7)
P5	8 August	Rock Ledge	2	1*	
P6	11 August	Stick	1	1*	
P7	11 August	Scrape Grassy Ledge	2?	0	
P8	12 August	Stick	3	0	
P9	15 August	Scrapes Observed	0	0	
P10	16 August	Scrape Grassy Ledge	1**	0	
P11	24 August	Scrape Grassy Ledge	2 - 3**	-	
P12	26 August	Scrape Grassy Ledge	3**	0	
P13	29 August	Scrape Grassy Ledge	2**	0	
P14	30 July	Scrape Grassy Ledge	?	?	
			27 - 29	3*	

* collected and sent to C.W.S. for pesticide analysis
\+ not visited on foot, young counted from aircraft
** young fully fledged and flying

TABLE III REPRODUCTION BY ROUGH-LEGGED HAWKS AT WAGER BAY, N.W.T.

Nest	Date Located	Number of Young	Population Production Statistics
R1	7 August	-	
R2	10 August	-	
R3	11 August	-	
R4	14 August	2	
R5	15 August	2	
R6	26 August	-	
R7	28 July	5	
R8	29 July	3	
R9	29 July		
R10	30 July	3	
R11	11 August	-	
Total		18	Number of young/successful nest = 18/6 = 3.0

TABLE IV OCCUPANCY AND PRODUCTIVITY OF PEREGRINE FALCONS IN ARCTIC AND SUB-ARCTIC AREAS

Area	Total Known Sites	Known Occupied 1975	Suspected Occupied 1975	Number Young Produced	Number of Sites Producing
(Tundra)					
West Greenland	9	8	0	12	5
Ungava Bay	27	11	0	16	9
E. Coast Hudson Bay	5	0	0	0	0
Interior Barrens	16	1	0	3	1
Central Arctic Coast	27	13	0	21	11
Horton River	15	5	0	9	3
Banks Island	14	7	0	18	6
North Slope Canada	12	5	0	-	?
N. E. Alaska	28	3	8	-	2+
Colville River	46	12	1	-	?
Totals	199	65	9	79+	37+
(Taiga)					
Mackenzie Valley	44	24	0	18+	14
Yukon River, Y.T.	15	6	0	2	2
Totals	59	30	0	20+	16
Wager Bay	14 + 3 suspected	13	3	27+	11

DISCUSSION

The 1976 raptor survey of the Wager Bay area revealed one of the most productive raptor nesting areas in the north. Wager Bay is particularly important as a breeding area for the rare and endangered peregrine falcon. This can be seen by comparing the productivity of the Wager Bay falcons with others in the north.

In 1975, a survey was conducted to determine the populations and productivity of peregrine falcons through North America (Fyfe et al., 1976). The results of that survey can be used to evaluate the importance of the Wager Bay population. Wager Bay had more producing peregrine falcon sites and produced more young than any area on the Arctic tundra surveyed during the 1975 survey (Table 4). It is likely that there were more producing peregrine falcons at Wager Bay than reported here. All the nest sites reported here were new discoveries. We had no prior knowledge of where nests were likely to be located at Wager Bay and only one of us had experience in locating raptor nests. Had we been able to quickly check known sites (as was done in other areas during the 1975 Peregrine Falcon Survey) and then spend the remainder of our limited aircraft time searching other areas, we feel confident that more sites would have been located.

The 1975 North American Peregrine Falcon Survey revealed that in many previously studied areas occupancy of known sites had declined (usually to 50% or less of initial occupancy) since the original survey in each area. Fyfe et al. (1976) summarized the situation as follows:

> "The situation in the Canadian Arctic is very much like that in northern Alaska. Most populations have declined to 50% or less of their historically known size. In five areas, i.e., Ungava Bay, the Interior Barrens, Central Arctic Coast, Banks Island, and the North Slope,

where we have some historical records upon which to base comparisons, only 41% of the historically known sites were occupied in 1975. Of the 86 known sites in these regions, only 30 were occupied by adult pairs in 1975."

Moreover, the productivity/pair declined in some areas as well. For example, in the Mackenzie Valley only 0.85 young/pair were produced as compared with 1.20/pair in 1970. On the Yukon River in Canada, peregrine falcons produced only 0.40 young/pair as compared with 2.0 young/pair in 1970. The only production figure which remained constant in most areas was the young/successful pair figure which usually stood between 2.0 and 3.0 young/successful pair. However, on the Yukon River, Mackenzie River, Ungava Bay, and Central Arctic Coast of the N.W.T., productivity dipped below 2.0 young/successful pair.

It is impossible to compare the occupancy which we observed at Wager Bay with occupancy of other areas reported during the 1975 survey. This is because we have no previous records of nest sites at Wager Bay to compare with the presently occupied sites. However, the average distance between occupied nests at Wager Bay (5.44 km) is comparable to nest spacing observed in healthy peregrine falcon populations (Table V). This suggests close to full occupancy of nest sites at Wager Bay. Similarly, the percentage of successful nests is difficult to compare with other areas. We would have been far more likely to locate productive pairs than unproductive pairs, since our surveys were conducted in late July and August. By these dates, many unproductive pairs might have left their nest sites.

TABLE V. Comparison of average distances between nests in several peregrine falcon populations.

Population	Average Inter-Nest Distance
Great Britain (sea cliffs)[1]	2.6 km
Great Britain (inland sites)[1]	4.8 km
Scotland (Western and Northwest Highlands)[1]	10.3 km
British Columbia (Queen Charlotte Islands)[2]	1.6 km
Alaska (Colville River)[3]	11.2 - 15.4 km
Northwest Territories (Campbell Lake)[4]	2.10 km
(Mackenzie River)[4]	3.63 km
Mean Distance	5.48 km
Wager Bay	5.44 km

1. Ratcliff (1969)
2. Beebe (1960)
3. Cade (1960)
4. Campbell & Davies (1972)

Certainly, the productivity of the Wager Bay population cannot be questioned. The figure of 2.45 young fledged/successful nest is well within the range expected for healthy populations (Hickey, 1969) and the total production of 27 young exceeds that for any other known population of Falco peregrinus tundrius.

Much has been written documenting declines in peregrine falcon populations and offering explanations for those declines. It is now generally agreed that organo-chlorine pesticides produce metabolic changes in the birds which cause egg shell thinning, and possibly infertility and abnormal behaviour, ultimately resulting in decreased production)Peakall, 1976).

Fyfe et al. (9176) attribute declines in the peregrine falcon population of Alaska and northern Canada to pesticides ingested while the falcons and/or their prey are wintering in South and Central America where the use of organo-chlorine pesticides is widespread and increasing. Disturbance also has been suggested to affect nesting success of peregrine falcons (Cade 1960) and possibly to act in concert with pesticides to depress reproductive success. It is interesting to note that the productivity of peregrine falcon populations has declined most along large northern rivers which experience boat, barge, and recreational canoe traffic. Productivity has been less affected in those populations occurring in more remote areas such as Greenland, and Canada's Central Arctic Coast.

Perhaps the productivity of the Wager Bay peregrine falcon population can be attributed both to low pesticide contamination and little disturbance. Analysis of one egg collected from a nest at Wager Bay shows low levels of pesticide residues (Fyfe, pers. comm.). Although this sample is small it suggests that the Wager Bay peregrine falcons are carrying smaller amounts of pesticide residue than those populations which have begun to experience reproductive failures. To confirm and understand the possibility of low levels of pesticides

in the Wager Bay peregrine falcons we need further collections of eggs. We also need to know where the falcons winter, where their prey winter, and what pesticide levels are present in the prey. Without this information we cannot predict the likelihood of reproductive failures in the peregrine falcon population of Wager Bay.

Certainly the Wager Bay falcons have suffered less disturbance than most other areas in the north. Wager Bay is remote, has rarely been explored for minerals, and is far from areas normally used for even wilderness recreation.

REQUIRED FURTHER STUDIES

Further studies are required in the Wager Bay area to determine the following:

1. How many of the nest sites occupied in 1976 will be reoccupied?
2. Will the high rate of productivity observed in 1976 continue or decline?
3. What levels of pesticides are occurring in infertile falcon eggs?
4. Can additional nest sites be located?

Similar studies should be extended to include other potentially productive areas of Northeastern Keewatin. Western Melville Peninsula, because of its rocky hills and river cliffs, its multitude of lakes, ponds, and streams, and its availability of bird and mammal prey species appears to be a prime potential nesting area for raptors. Similarly, the Baker Lake area and Rankin Inlet region should be searched for nesting raptors as surveys by game officers and reports by geological parties have indicated several peregrine nests in each area. The pipeline route itself (once more firmly established) should be searched for nesting raptors.

These surveys are required to establish baseline information on numbers and productivity of raptors throughout the region. Such information will be valuable in determining the relative importance of individual raptor nest sites on any pipeline route chosen through the region. The information gathered regionally can also be used to evaluate post-construction changes in productivity in raptors along a particular pipeline route.

If the population declines being experienced by many northern peregrine populations are attributable to pesticides accumulated while the birds winter in South America, then we must know where the Eastern Keewatin peregrines winter to know whether they are similarly imperiled. The only way to obtain this information is by banding nestlings. Therefore, it is suggested that during future surveys all nestlings be banded.

Finally, collections should be made of prey species important to peregrine falcons. Prey specimens can then be analysed for pesticide residues.

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FEB 18 '82			

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CALEF, George W. et al.
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